Claims:

1. A method for using frequency diversity to spatial demultiplex a plurality of interfering signals comprising:

providing for transformation of an input signal that includes the plurality of interfering signals into a plurality of spectral components, the spectral components having complex amplitudes corresponding to unique complex amplitude-versus-frequency profiles for each of the interfering signals,

providing for computation of a set of weights with respect to the complex amplitude-versus-frequency profiles,

providing for application of said weights to said spectral components, and

providing for combining the weighted spectral components to cancel co-channel interference.

2. The method of claim 1 wherein the input signal includes samples of at least one of a set of signals including a spread-spectrum signal, a multicarrier signal, code division multiple access signal, a discreet-time signal, and a continuous-time signal.

3. The method of claim 1 wherein step of transforming the discreet-time input signal into the plurality of spectral components includes decoding at least one multicarrier signal in the input signal, the multicarrier signal characterized by a plurality of carriers each having a different spreading code.

4. A method for using frequency diversity to spatial demultiplex a plurality of interfering signals comprising:

providing for transformation of a discreet-time input signal into a plurality of spectral components, the discreet-time input signal including the plurality of interfering signals, the spectral components having differences in either or both amplitude variations and phase variations, and

providing for separation of the interfering signals by processing either or both the amplitude variations and the phase variations of the plurality of spectral components.

5. The method of claim 4 wherein the step of providing for separation of the interfering signals includes a constellation processing method.

6. The method of claim 4 wherein the step of providing for transformation of a discreet-time input signal includes deriving at least one discreet-time input signal from a plurality of received signals, the received signals being transmitted signals that have propagated in a free-space or guided-wave environment after being transmitted by a plurality of transmitters.

7. A method of using complex amplitude versus diversity parameter values to perform spatial demultiplexing of interfering signals comprising:

providing for transformation of a receive signal into a plurality of diversity components, the receive signal including a plurality of the interfering signals, the diversity components having differences in either or both amplitude distributions and phase distributions, and

providing for separation of the interfering signals by processing either or both the amplitude variations and the phase variations of the plurality of diversity components.

8. The method of claim 7 wherein the step of providing for transformation includes polarization processing and the diversity components include polarization-diversity components.

9. The method of claim 7 further comprising providing for adjusting at least one spatial gain distribution of at least one of the received signals.

10. The method of claim 9 wherein the step of adjusting spatial gain distributions includes adjusting spatial gain distribution characteristics of at least one of a plurality of transmitted signals.

11. An apparatus capable of spatially separating a plurality of interfering information-bearing received signals, each of the received signals having a different amplitude-versus-frequency profile, the apparatus including:

at least one diversity receiver adapted to separate the received signals into a plurality of frequency components, and

at least one spatial interferometry demultiplexer adapted to process the frequency components to separate at least one information signal from at least one interfering signal.

12. The apparatus of claim 11 wherein the spatial demultiplexer comprises:

a weight generation unit adapted to generate a plurality of weights based on the amplitude-versus-frequency profiles of the received signals, and

a combining unit adapted to provide weighting and combining of the plurality of received signals using the generated plurality of weights to enhance signal to interference of at least one of the received signal by canceling interfering signals.

13. A method of producing diversity-encoded spread-spectrum signals comprising:

providing for generation of at least one wideband electromagnetic signal,

providing for impressing an information signal onto the at least one wideband signal to produce at least one spread-spectrum signal,

providing for duplicating the spread-spectrum signal to generate a plurality of spread-spectrum signals, and

providing for diversity-encoding of at least one of the spread-spectrum signals.

14. The method of producing diversity-encoded spread-spectrum signals recited in Claim 13 wherein the step of providing for diversity encoding includes at least one item of a set of providing a time offset, polarizing, applying a predetermined directionality, transmitting from a plurality of spatially separated transmitters, modulating with a predetermined carrier frequency, combining with a carrier having a predetermined mode, and transmitting the spread–spectrum signals in at least one predetermined subspace channel.

15. A method of producing diversity-encoded spread-spectrum signals comprising:

providing for generating at least one information-bearing wideband radio signal,

providing for generating at least one decoding signal, and

providing for diversity-encoding of at least one of the information-bearing wideband signal and the decoding signal.

16. The method of producing diversity-encoded spread-spectrum signals recited in Claim 15 wherein the step of providing for diversity encoding includes at least one item of a set of providing a time offset, polarizing, applying a predetermined directionality, transmitting from a plurality of spatially separated transmitters, modulating with a predetermined carrier frequency, combining with a carrier having a predetermined mode, and transmitting the signals in at least one predetermined subspace channel.

17. A spread-spectrum transmitter capable of transmitting diversity-coded spread-spectrum radio signals, the transmitter comprising:

a wideband-signal generator adapted to generate at least one wideband signal,

an information signal generator adapted to generate at least one information signal,

a modulator coupled to the wideband signal generator and the information signal generator, the modulator adapted to combine at least one information signal with at least one wideband signal for generating at least one spread-spectrum signal, and

a diversity processor adapted to duplicate the at least one spread-spectrum signal to provide a plurality of duplicate spread-spectrum signals and adjust at least one diversity parameter of at least one of the duplicate spread-spectrum signals to enable separation of the adjusted signal from the at least one unadjusted signal.

18. A spread-spectrum transmitter capable of transmitting spread-spectrum coded, diversity-coded signals, the transmitter comprising:

a wideband-signal generator adapted to generate at least one wideband radio signal,

an information signal generator adapted to generate at least one information signal,

a modulator coupled to the wideband signal generator and the information signal generator, the modulator adapted to combine at least one information signal with at least one wideband signal for generating at least one spread-spectrum signal, and

a diversity processor adapted to adjust at least one diversity parameter of at least one of the spread-spectrum signal and the wideband signal to enable separation of the adjusted signal from the at least one unadjusted signals.

19. A spread-spectrum receiver capable of extracting an information signal from a plurality of diversity-coded spread-spectrum radio signals, the receiver comprising:

a receiving system adapted to receive the diversity-coded spread-spectrum signals,

a diversity processor coupled to the receiving system, the diversity processor adapted to diversity decode at least one of the received signals to provide a plurality of signals that are highly correlated, and

a signal combiner coupled to the diversity processor, the signal combiner adapted to correlate or otherwise combine the plurality of highly correlated signals to generate a correlation signal indicative of the information signal.

20. A spread-spectrum receiver capable of extracting an information signal from at least one diversity-coded spread-spectrum radio signal, the receiver comprising:

a receiving system adapted to receive the at least one diversity-coded signal and receive at least one despreading signal, the received despreading signal being separable from the at least one spectrum-coded signal,

a diversity processor coupled to the receiving system, the diversity processor adapted to diversity decode at least one of the received signals to generate a plurality of signals that are highly correlated, and

a signal combiner coupled to the diversity processor, the signal combiner adapted to correlate or otherwise combining the plurality of highly correlated signals to generate a correlation signal indicative of the information signal.

21. A receiver capable of receiving and separating a plurality of information signals, the receiver including:

a sampler adapted to sample received information signals to produce at least one algebraically unique combination of information signals,

a nonlinear processor adapted to apply a nonlinear process to at least one signal of the algebraically unique combination of information signals to increase the number of combinations, and

a multi-user detector adapted to provide information about at least one of the information signals in order to calculate at least one information-signal value.